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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/666,787 | 09/19/2003 | Yoshimasa Okamura | 03650.002191 | 8996 |

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| EXAMINER |
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ARBES, CARL J

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| ART UNIT | PAPER NUMBER |
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3729

DATE MAILED: 03/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|------------------------|---|--|
| Office Action Summary | Application No. | Applicant(s) | |
| | 10/666,787 | OKAMURA ET AL. (1) | |
| | Examiner | Art Unit | |
| | C. J. Arbes | 3729 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>hereto</u> . | 6) <input type="checkbox"/> Other: _____ |

The specification needs clarification inasmuch as on page 11, lines 3 and 4 thereof the sentence beginning with --Preferably, a genetic algorithm... -- must be further disclosed or described. What do Applicants intend to disclose by using this language. Is there a common "genetic algorithm" in use for this problem? Are there many? If so what is a common one? What genetic algorithm do Applicants use? Why did Applicants choose the one that they did? The sentence on the top of page 11 of Applicants' specification has little or no meaning to the Examiner and hence Applicants are requested to describe what is meant in more or clearer detail. The specification is therefore held to be non-enabling under 35 U.S.C. 112 (1st Para) The specification is also found to be non-enabling under 35 U.S.C. 112 (1st Para) for the following reason. Beginning on page 15 of Applicants' specification Applicants disclose what they term ...a preferred method of forming nanopores... (which applicants admit is a critical part of the invention). However they merely disclose that the so-called nanopores are formed...through anodic oxidation.... Applicants further disclose that ...any material which is suitable for anodic oxidation may be used for nanopore formation layers although Aluminum is preferred. It is believed that this disclosure is very limited in detail and in fact would not be sufficient for a POSITA to perform the claimed invention. The frontiers of this new science (or art) wherein the nano-particles behave in unorthodox e.g. reactivity of nano particle gold particles in strong acids makes clear that Applicants have a higher or more specific duty to disclose how they perform the claimed invention particularly how they form the nanowires (i.e. p-type and/or n-type). To this issue Applicants may attempt to rebut the Office's position that indeed the application is not

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claiming the nanowire but is claiming a method of fabricating a nanowire thermoelectric device. In response to this argument the application calls for the use of nanowires and therefore nano wires are necessary for Applicants invention to properly operate.

Moreover nanowires particularly the ones that Applicants are claiming are not off-the-shelf items at this stage.. Although Applicants disclose that e.g. nanopores have a diameter of 5nm to 500 nm (Cf. Page 17) and more preferably a diameter of 10nm to 50 nm and a pitch of 200 nm (Cf Page 17) Applicants disclose nothing about what temperatures, starting materials, pressures, sizes of starting materials which are used, times at the temperatures or many other (and important) parameters which must or can be used to obtain the desired nanowires and also the desired pitch between these extremely small electrical element. Additional Applicants are deficient in the yield or amount (if any) of successful results which result from Applicants' claimed invention. Moreover Applicants do not disclose the limits of how much current or heat the claimed invention can produce or transfer. Only the broadest characteristics of the claimed invention is actually disclosed. There is not one specific example of how the starting material was chosen where it was bought or made or what its initial characteristics were. Applicants do not disclose how in fact they arrived at the optimum diameter of these so called nanopores which appear to be critical to the claimed invention. On the top of page 19 of Applicants' specification Applicants disclose that they cover the nanowires with resist or use resist to block a deposition of n-type materials In the nanopores for p-type materials. Applicants are requested to more clearly explain the details and procedures of how this portion of the protocol is performed. It appears to

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be almost impossible to achieve with the standard or ordinary resist coverage techniques. How do applicants do this resist coverage, particularly when they block the deposition or formation of n-type materials in nanopores meant for p-type materials? Further on Page 19 of applicants' specification, Applicants disclose ... If the nanopore formation layer is removed ... throughout the device fabrication. It is not understood nor do applicants disclose how the nanopore formation layer is removed. Applicant is either requested to submit affidavits from POSITAs (not inventors), publications, patents, or the like which carefully disclose how and by what method these nanopores are removed or indicate specifically how Applicants remove the nanopore layer. On page 20 of Applicants specification Applicants disclose that a vacuum can be used as a means to keep space around nanowires electrically isolated from each other. It is again far from clear or certain what the characteristics of such vacuum would be in terms of quantity, quality, temperature and the like. How would the vacuum be applied? What means would generate the vacuum? What temperature would the vacuum operate? Near the top of page 22 of Applicants' specification Applicants again disclose that they can block the nanopore with a photoresist or photomask. As was pointed hereinabove it is not understood not do applicants carefully explain how this process can take place so as to apply to these so very small particle sizes as the nanopore. The Examiner is at a lost to understand what specific parameters are used by the Applicants to effect this "blocking" step. Applicants also disclose that these thermocouples (i.e nanowires) can be connected into series and/or in parallel (Cf Page 23). Again Applicants make little or no attempt to help the reader to actually describe or disclose how these connections are

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made. Applicants appear to again remember that the science (or art) which deal with nanoparticles is quite new and therefore the ways and steps one must use in dealing with these particles or items must be carefully described or disclosed. Particularly it is far from clear how Applicants connect the nanowires in series to attain their intended results. Applicants merely disclose some theoretical model for fabricating a nanowire thermoelectric device without giving substantial or enough details of the method/s which they used to perform the claimed invention. The specification therefore is held to be non-enabling under the law and accordingly Claims 1-21 are rejected under 35 U.S.C. 112 (1st Para). Alternatively there is an inadequate description of the claimed invention and therefore Claims 1-21 are rejected.

Claims 1-21 are rejected under 35 U.S.C. 112, first paragraph, as being based on a specification which fails to comply with the enablement requirement. The claims contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. See the remarks *supra*.

Claims 1-21 are further rejected under 35 U.S.C. 112, first paragraph, as being based on a specification which fails to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. See the remarks *supra*.

Claims 1-21, assuming the specification complies with 35 U.S.C. 112 (1st and 2nd Paragraphs) are further rejected under 35 U.S.C. 103(a) as being unpatentable over the Conference paper titled "A New Type of Micro-thermoelectric Power Generator Fabricated by Nanowire Array Thermoelectric Material" by Wang et al 2003 Twenty Second Intr. Conf on- ICT, 17-21, August 2003, hereinafter "Wang et al".

Wang et al teach a fabrication process using nanowire arrays. The process comprises providing a substrate upon which to form nanowires, forming a first electrode pattern on the bottom surface of the substrate (See Figure 3, page 683), forming a p-type nanowire on the substrate by activating an electrically group of substrate electrodes, forming a n-type nanowire on the substrate by activating at least one other electrically connected group of substrate electrodes (Cf. also Fig 3), forming top electrodes to connect the p-type nanowire and the n-type nanowire. If it is not evident or obvious to form a second electrode pattern on the bottom surface of the substrate to replace the first electrode pattern (such that a thermocouple is formed) then it is held to have been within the ordinary skill of a POSITA to do so given the Wang et al teaching. Wang et al teaches a nanopore formation layer (which is Al and anodic oxidation) which is placed on the substrate.. As applied to claim 11 it is held to be within the ordinary skill of a POSITA to apply a genetic algorithm to determine a second electrode pattern which optimizes the connection of the thermocouples. Alternatively the application of such a algorithm is held to have been mere design choice inasmuch as applicant has provided no specific purpose for such algorithm nor has there been any specific problem addressed by using this algorithm.. Although Wang et al fail to


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expressly teach creating a vacuum around the nanowires such vacuum creation is held to have been obvious since workers in this art have been using vacuum in order to insure the stability longevity of these nanowires elements. As applied to 18-20 although Wang et al expressly recite the diameters of the nanowires which they are using, it is believed that these workers would be attempting to achieve the same order of diameters which are recited by applicants (N.B. The Examiner is holding that the instant Application has also failed to disclose how the Applicants are able to achieve this nanowire diameter arrangement they are now claiming.)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to C. J. Arbes whose telephone number is 571-272-4563. The examiner can normally be reached on M, T, R and F from 8 to 6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, P. Vo, can be reached on 571-272-4690. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


CARL J. ARBES
PRIMARY EXAMINER